IT Investment and Firm Performance in U.S. Retail Trade

Preliminary And Incomplete
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Introduction

This paper analyzes productivity growth in the trade sector using previously untapped data at the Census Bureau (The trade sector includes both the wholesale and retail sectors. We have not yet incorporated the wholesale data into our analysis but will do so in future drafts). This project is motivated by several reasons. First, we want to explore possible reasons for the pick-up in productivity growth in the U.S. since 1995--productivity growth in the retail sector was especially strong in the last half of the 1990s, and, frankly, not much is known as to why this is the case.[3] The second motivating factor is to extend a rich literature and tradition of analyzing productivity growth of establishments and firms in manufacturing to other significant portions of the economy.[4] In particular, we examine the roles of turnover, entry and exit in aggregate productivity growth. Also, we extend our analysis to see how these changes are correlated with information on capital spending and spending on information technology. This paper is a first stab at this analysis.

Productivity analysis of the trade sector faces several hurdles. First, measuring output is problematic, and we don't offer much in terms of solving this problem. Sales per employee is a simple measure and intuitively appealing for the trade sector. It is also appealing because it is easy to compute. However, sales per employee misses the concept of value added. A measure of value-added for the trade sector that is used in the input-output tables is the trade sector's margin--revenue net of variable costs (mostly the cost of goods sold). In the analysis presented here, we use sales per employee, although in the future we will extend our analysis to value added per employee, similar to the measure used in manufacturing. Foster, Haltiwanger, and Krizan (2000) have been examining productivity growth in the retail sector using the Census of Retail, an establishment based survey and use sales per employee as their productivity measure. In order to calculate other measures of productivity, data has to be retrieved from several other sources.

The second largest hurdle in examining productivity in the trade sector at the micro-level is being able to get appropriate data. In manufacturing, the value of outputs

[3] For reasons that we discuss below, measuring productivity in the retail trade sector is very difficult. Consequently, research in this area is limited. For a discussion of BLS's work on measuring productivity, see Dumas (1997).

[4] Foster, Haltiwanger and Krizan (1998) and Bartlesman and Doms (2000) both discuss the usefulness of using micro data in understanding aggregate productivity growth.

and inputs for establishments is collected in a single survey, the Annual Survey of Manufacturers. Unfortunately, the variables needed to construct productivity for the trade sector are scattered across different surveys with different sampling frames and units of observation. We discuss how the various survey data were combined. Perhaps the largest contribution this paper/project isn't why productivity growth has accelerated, but rather exploring how productivity analysis can be conducted using Census data.

Some basic facts about the trade sector

Before moving onto to the description of the data and our preliminary results, let us address the question of why we care about productivity growth in the retail trade sector and why we think examining micro-data will help us gain a better understanding of this productivity growth.

The trade sector is a large part of the economy. The upper panel of table 1 presents the output by sector from BEA's Gross Product Originating Database--output corresponds to value added, so that the sum across all sectors equals GDP. The trade sector's share of output was about the same as that of manufacturing in 1999, about 16 percent. Further, the share for the trade sector has grown significantly faster than manufacturing's since 1992.

The second panel in table 2 shows employment by industry. Trade sector employment was about 60 percent greater than manufacturing employment in 1999. As in output, the growth in employment has been greater in the trade sector than in manufacturing, especially in retail.

The third panel in table 1 presents a crude measure of labor productivity--output per employee (a better measure would be to use hours worked, but the qualitative results remain the same). Since 1992, productivity growth in the trade sectors and in manufacturing averaged a bit more than 4 percent per year, greater than the average for the entire economy. Since 1995, productivity growth picked up significantly in the trade sector, especially for retail. Given the great interest surrounding the rebound in aggregate productivity growth since 1995, it is interesting that the retail sector's productivity growth also picked up. "Why is this the case?" is one of the motivating factors behind the research in this paper.

There is tremendous variation within retail and wholesale trade in terms of activity. Table 1b presents the employment breakdowns by two-digit industry. These

employment figures are from the censuses and not from BLS. Retail trade is a diverse industry, covering eating and drinking place, cat dealers, shoe stores, department stores, and a wide variety of other retail establishments. The single largest two-digit category is eating and drinking establishments followed by food stores. Within wholesale trade, there is less diversity at a two-digit level, just a distinction between durable and non-durable goods.

Productivity Analysis Using Micro Data

Generally speaking, micro data (firm or establishment data) has been used in one of two ways in examining productivity growth. First, aggregate productivity growth has been decomposed to measure the effects of entry, exit, and changes in market share. For instance, does aggregate productivity grow simply because relatively inefficient firms close? These decompositions have been done primarily for manufacturing where the data are amenable to such tasks.

The second use of microdata in productivity analysis has been used to examine factors that are correlated with productivity--such as the use of advanced technology, location relative to other firms in the industry, skill of the labor force, and so on. Basically, this second branch of the literature takes one of the elements of the traditional KLEM model and tries to improve upon it in a way.

Now let's take a step back and hypothesize what may be occurring in the trade sector, and what, therefore, may be driving productivity growth. One hypothesis is the Wal-Mart or Starbucks factor. This hypothesis is that relatively productive firms, such as Wal-Mart or Starbucks, open a large number of establishments, increasing the market share of these firms. Relatively inefficient firms (K-Mart and Brother's Coffee) are driven out of the market. One factor that may make Wal-Mart successful is their use of information technology (there are numerous case studies supporting this claim). Not only does Wal-Mart make substantial investments in IT, Wal-Mart knows how to make these investments pay-off more so than other firms. In the case of Starbucks, other factors may be at work, such as a consistently produced product that appeals to a large set of consumers.

Another hypothesis as to why productivity is growing so rapidly in the trade sector is that all firms in the trade sector are becoming more efficient--new technologies become available to a wide number of firms that successfully adopt these technologies.

Which hypothesis most closely lines up with the data is the empirical question that we explore.

Data

We use micro data from two Census Bureau programs since no single program collects data on all the variables we need. First, we use establishment level data from the 1992 and 1997 Censuses of Retail Trade. The Census of Retail Trade (CRT) files at CES contain information on the universe of retail establishments and are the source for the measures of labor productivity we use below. To construct measures of total capital and computer investment, we use the 1992 Asset and Expenditures Survey (AES).

An additional survey that we plan to use is the Annual Survey of Retail Trade. This survey provides that information required to compute the cost of goods sold, akin to the concept of material purchases in the Annual Survey of Manufacturers. Another piece of information in the annual survey is inventories. Inventory-sales ratios for retail have fallen about 7 percent since 1992 after being at a flat and relatively stable level during much of the 1980s.

For the manufacturing sector, it is possible to match production and investment data at the establishment level. This is not the case in retail, however. For the reference year 1992, investment and expenditure data were collected for the retail sector via the AES. While performed as part of the 1992 Economic Census, the sampling frame for the retail portion of the AES was the one used, at the time, for the Monthly and Annual Retail Trade Surveys. As a result, the sampling units in the 1992 AES are substantially different from the establishment units used in the CRT. Differences in sampling units and methodology across the Census and the AES make merging the information from them difficult. Below we describe the methods we employed to create the matched research data set used in the analysis. First we describe our two primary datasets in more detail.

Census of Retail Trade

As part of the Economic Census carried out every 5 years, the Census Bureau collects data for the universe of retail establishments. In an effort to reduce reporting

burden on smaller businesses, only establishments with a specified minimum number of paid employees (this number varies by industry, but is generally around 10) are canvassed. Administrative data are use for small employer and non-employer establishments that are non mailed Census forms. Primary information on payroll, employment, sales, location and industrial classification is obtained for all retail establishments (both the mail and non-mail segments). Additional information on merchandise lines and selected other items are collected from the mail segment. For the current analysis, we are interested only in the base information on sales, employment and so on.

An establishment is a single physical location where business is conducted. The frame for the CRT, and other Economic Censuses, is the Standard Statistical Establishment List (SSEL). Since administrative data from the SSEL are used directly in the CRT and because the CRT and SSEL share a common structure its useful to briefly describe the SSEL.

The SSEL has two principal components. First, the Census Bureau receives information on taxpaying businesses from the Internal Revenue Service (IRS). This information corresponds to legal tax paying entities and the unit corresponds with the Employer Identification Number (EIN). The majority of businesses, in and outside of retail, have only one location. In these cases, the EI administrative reporting unit the Census receives from the IRS and the establishment are the same thing. When a new single establishment EIN arrives on IRS files, Census assigns both a Census File Number (or CFN, which is usually just the EIN) and a Permanent Plant Number (PPN). Both numbers are unique to a physical establishment. However, the CFN is intended to incorporate information about the ownership of the establishment and can change as the ownership of other legal aspects of the establishment changes. The PPN remains the same as long as the establishment remains open in the same location, even if it changes hands.

Second, the Census Bureau annually surveys multi-location companies inquiring about the location, employment and industrial classification of all its establishments. The Company Organization Survey (COS), the Economic Censuses and other surveys are used to maintain the list of mulit-unit (those owned by multi-location companies) establishments. Multi-unit establishments are also assigned CFNs and PPNs. Again, they are unique to the establishment and the CFN contains information about the ownership of the establishment. Unlike in the single unit case, where they all refer to the

same thing, the EI administrative reporting unit, the firm and the establishment can be very different for multi-units. This means the numeric identifiers: EIN, CFN and PPN all refer to different units. For multi-unit establishments, the CFN contains an "ALPHA' code which identifies the firm that owns the establishment. An ALPHA can "own" many EINs, each of which can have several PPNs and CFNs associated with them.

This ID structure is mapped directly to establishments in the CRT. These IDs are how researchers at CES can link establishments, firms and firm segments across different surveys. In most cases, these links are between like units (e.g., PPN to PPN or ALPHA to ALPHA). This is not the case when linking the AES and the CRT as our discussion of the AES below shows.

1992 Asset and Expenditures Survey

Data on total capital expenditures and computer investment for the retail sector in 1992 are available from the 1992 Asset and Expenditure Survey (AES), which was done as part of the 1992 Economic Census. Detailed (by type of equipment) annual investment data are not available for retail establishments from any Census Bureau survey. In 1998, the Annual Capital Expenditure Survey (ACES) asked firms (at the ALPHA level) to break out capital expenditures by equipment type. In addition, most capital expenditure items were taken off the 1997 version of the AES, which is now known as the Business Expenditure Survey (BES), so as not to duplicate inquiries in the ACES.

As mentioned above, the sampling frame for the1992 AES was that for Annual and Monthly Retail Trade Surveys. These surveys use significantly different sampling units than the establishments used in the CRT. The 1992 AES, following the sampling methodology of the Annual Retail Trade Survey (ARTS) was comprised of a "list" sample and an "area" sample. We do not use any of the data from the area sample, so we won't discuss it here (see U.S. Census Bureau, 1996 for discussion on the area sample). The list sample has two sub-lists for different types of records, EI and ALPHA records.

Large multi-location retailers identified from the 1989 COS make up the first (ALPHA) list. Their establishments (and their corresponding EINs) were removed from the SSEL. The remaining establishments and their corresponding EINs make up the EI list. Most of the units in the ALPHA list are large multi-unit retailers that were selected in to the ARTS and, thus, the AES with certainty. These units typically correspond to an

entire large retail company, but some larger retailers can have more that one reporting unit where the units are separated by major kind of business, and still others may have kinds of business that are out of scope for the CRT (e.g., wholesale or manufacturing establishments).

Smaller multi-unit and single unit retailers are contained in the EI sub-list. The ARTS chooses three rotating probability samples from this list and the AES uses two of the three. For all businesses in the EI list, the EIN is the sampling unit. Therefore, it is possible for a multi-unit EI list company (an ALPHA) with more than one EI to be represented in the AES more than once, but for distinct segments of the firm.

Matching the AES to the CRT

It is not possible to obtain exact unit to unit matches between the AES and the CRT for all multi-unit retailers. There is not an accurate mapping between the sampling units on the AES (identified numerically by AESID) and the establishments in the CRT that the AES sampling units are intended to represent. This is due to timing issues surrounding drawing the ARTS/AES sample and when the CRT is done. In addition, the ARTS is voluntary and the Census Bureau grants companies a lot of latitude in how they report in order to obtain their participation.

Matching the AES to the CRT is not too problematic for EI cases since the EI sampling unit in the AES is intended to cover all establishments (usually only one) operating under a given EIN. The ALPHA cases, which account for a large amount of retail activity, are more difficult. For matching purposes, the unit of analysis in these can be thought of as an ALPHA - kind of business combination. That is the sampling unit is intended to describe the activities of a company within a given industrial, geographic or other classification. We match at the ALPHA – two digit SIC (kind of business) level.

The 1992 AES contained 20,355 EI units and 2810 ALPHA units. The ALPHA units collapse to 2024 ALPHA – two digit SIC combinations. We matched 15,498 of the 20,355 EI units to the CRT. These EIs corresponded to 32,731 establishments. We matched 1631 of the 2024 ALPHA – two digit SIC units to the CRT. These companies had 228,982 establishments in the 1992 CRT. The result is a matched dataset with 17,129 “firms.” Note that what we are calling a firm, does not always match the legal definition of many large enterprises.

Results

Our goal is to better understand the processes generating productivity growth and improved firm performance in the retail trade sector. The matched AES – CRT dataset we constructed allows us to exploit cross sectional variation in the intensity of computer and total capital investment and in labor productivity growth to see if firms that invested heavily in 1992 enjoyed more productivity growth over the 1992 to 1997 period. In the retail sector, perhaps more so that other sectors, increases in the number of establishments a firm operates are good signals of firm success. We examine this below as well.

Descriptive Results

Sector Wide

Tables 2 and 3 contain descriptive statistics for the "quasi-firm" units we constructed from the CRT. All establishments, in both the 1992 and 1997 CRTs, are represented. We list the number of firms in each year as well as the number of surviving, or continuing, firms by size class. The table shows that there is considerable turnover amongst retail firms, especially in the smaller size categories. Work by Foster, Haltiwanger and Krizan (2000) suggests that net entry of establishments drives most aggregate retail productivity growth over a similar time period.

While we don't focus on it here, there is considerably turnover at the establishment level. However, our results indicate that much of that establishment level turnover occurs within continuing firms, especially large firms. Results in Table 2 show that large continuing retailers contributed approximately half (17,277 of 34,980) of the increase in retail establishments between 1992 and 1997. Even more importantly perhaps, is the fact that large retailers contributed approximately 58% of the over 2.7 million net increase in retail employment over the 92 to 97 period.

Table 3 gives some basic statistics for labor productivity (sales per worker) for 1992 and 1997 and gives the average firm level change in productivity. All productivity calculations are nominal, at this point. The results suggest that the productivity performance of large retailers is rather similar to all but the smallest firms.

Matched AES – CRT Sample

Table 4 shows descriptive statistics for our matched sample of AES – CRT data. The AES covers most large retailers with certainty in order to cover as much retail activity as possible, while holding the sample size and respondent burden to a minimum. As a result, even though our matched sample only covers 17,129 of the 1,071,737 retail firms in the 1992 CRT, it covers a sizable portion of retail employment and sales. Productivity growth between 1992 and 1997 does not vary strikingly across the size distribution, as was the case for retail as a whole. Firms in the matched sample do tend, however, to be larger and more productive than the typical firm in the entire retail universe.

The matched data allow us to look at the relationship between capital intensity and firm performance. The AES asks for total capital expenditures and for expenditures on selected types of equipment, such as computers. It does not include questions on stocks and we don't have time series data available at the firm level to construct capital stock measures. However, we are interested only in the cross sectional variation in capital and computer intensity. Previous work (Adams 19??) indicates that the patterns of cross sectional variation in investment and capital stocks are very similar. Therefore, we proxy total capital and computer intensities with, respectively, total and computer investment per dollar of sales.

In table 5, we provided basic statistics on establishments, employment and productivity by capital and computer investment intensity categories. The table shows striking differences in the productivity performance of firms according to capital and computer intensities. Also, establishment and employment growth for the matched AES – CRT sample is concentrated entirely among firms with high capital and/or computer intensities. The productivity growth premium to being the high total and high computer intensity category is particularly interesting.

Regression Results

To get a better handle on the role that investments in IT have in firm performance, we turn now to some simple regressions. We use two dependent variables in our analysis: labor productivity and establishment growth between 1992 and 1997. The construction of these measures means our analysis focuses on those firms

that were active in both years. This could be a problem in light of the findings of Foster, Haltiwanger and Krizan (2000) who show that net entry accounts for a large portion of aggregate productivity growth in the retail sector. However, recall their results are based on the net entry of establishments. We are looking at firms here and, as table 2 shows, continuing firms (especially large ones) account for a substantial portion of net establishment entry.

Before turning to the regressions, let us compare the characteristics of the firms in our matched subset, and used in our regressions, to the entire retail population. Our regressions are basically a cross sectional analyses of firms present in both 1992 and 1997 using 1992 characteristics as regressors. Thus, table 6 and 7 show some basic statistics on the number, size, number of establishments and productivity for all firms, and for our matched subset. Table 7 also lists statistics on capital and computer expenditures for the matched AES-CRT subset. Characteristics are given by 2 digit SIC in both tables. As expected, firms in the matched subset are much larger and more productive than the general population of retailers. Interestingly, there is no obvious correlation between the intensity of computer investment in a 2-digit industry and its productivity growth.

Productivity Growth Results

We are interested in seeing whether retail firms that use more capital, both IT and total, enjoy more productivity growth and are more likely to expand their operations by increasing the number of retail establishments. In the AES, most respondents had either zero or missing responses to the question on IT spending and over a third had zero or missing total capital expenditures. We include dummies for zero or missing responses to both the total and IT investment variables in our regression. We group firms reporting non-zero investment into investment intensity (investment/sales) quartiles.

Table 8 contains results from regressions looking at the impact of total and IT investment intensities on labor productivity growth between 1992 and 1997. The regressions control for firm size, average (within firm) wage, and two digit SIC. The results show that productivity growth is lagging at very small retailers compared to their larger counterparts. Curiously, the results here suggest that higher wage firms enjoy less productivity growth. This result runs counter from what we would expect to find

from studies using manufacturing micro data. This finding was robust to alternative specifications of the wage variable. At this point, we are not sure what to make of this result. Average wages differ considerably across differ types of retail businesses, even within two digit groups. Our industry controls are very crude and it could be that firms in industries with lower average wages are those that are experiencing higher productivity growth.

The results show that the productivity growth premium for higher levels of total investment intensity is concentrated in the highest investment intensity quartile. The relationship between computer investment intensities and productivity growth is monotonically increasing across the quartiles. This is true even when we control for both total and computer investment. Firms in the highest computer investment quartile experienced approximately 12% higher productivity growth that those in the lowest (but still positive) quartile. Those firms in both the highest total and computer intensity quartiles had 23% higher productivity growth that those in both of the lowest quartiles.

Establishment Growth Results

Table 9 show results from similar regressions where the dependent variable is log change in the number of establishment at retail firms. This is good measure of overall firm performance in retail. Even with the Internet and catalogue shopping, most retail markets are local. A firm's participation is a given market is indicated by the presence of one its establishments in that market. Firms that are successful expand into additional markets.

The results in Table 9 show that only those firms in the highest computer and total investment intensity quartiles experience higher growth rates in the number of establishments. While the differences are not statistically significant, the relative magnitude of the computer and total investment coefficients in the third regression suggest that that computer investment is the more important driver here.

Conclusions

The retail trade sector in the U.S. has experienced considerable growth over the last several years. In addition, the sector has enjoyed substantial productivity growth over the same period. The reasons for this impressive performance are not well

understood and there is, generally, little focus on the sector by researchers. Part of this lack of attention can be attributed to a lack of good micro level data with which to study the retail sector. In this paper, we have brought different Census Bureau micro datasets together for the first time to examine potential explanations of productivity growth among firms in the retail sector.

In particular we focus on the role played by computer investment. There is a sense in the popular imagination that large, technically sophisticated retailers are displacing smaller retailers. It is also widely thought that an important part of the business plan of these larger sophisticated retailers is a heavy reliance on information technology. Thus, we examine the relationship between IT intensity and labor productivity growth.

Our results are still preliminary, so we hesitate drawing too much from them. However, the patterns we see in the data are consistent with anecdotal evidence that many areas in retail are seeing large sophisticated companies introducing new technologies and processes and displacing less sophisticated retailers.

However, there is more that needs to be done before we can more fully describe this process. We are currently in the process of incorporating data from the Annual Retail Trade Survey so that we can analyze the relationship between computer investment and both value added per employee (rather than sales per employee) and inventories. There is also, much more to do on seeing how measures of technical sophistication like computer investment interact with entry and exit patterns of both firms and establishments to yield improved performance in the retail sector. Finally, we want to expand our analysis to cover the entire Trade Sector.

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Table 1: Basic Facts for Retail and Wholesale Trade

Output by Industry (billions, $1992)	1992	1993	1994	1995	1996	1997	1998	1999
Total (GDP)	6,318.9	6,642.3	7,054.3	7,400.5	7,813.2	8,318.4	8,790.2	9,299.2
Trade	966.3	1,010.5	1,099.8	1,147.4	1,216.7	1,307.3	1,407.7	1,499.7
Retail	551.7	578.0	620.6	646.8	687.1	740.5	796.8	856.4
Wholesale	414.6	432.5	479.2	500.6	529.6	566.8	610.9	643.3
Manufacturing	1,082.00	1,131.4	1,223.2	1,289.1	1,316.0	1,379.6	1,436.0	1,500.8

Source: BEA, Gross Product by Industry

Employment	1992	1993	1994	1995	1996	1997	1998	1999
Total Nonfarm Employees (1000s)	108,591	110,692	114,135	117,188	119,597	122,677	125,845	128,772
Trade	25,352	25,753	26,664	27,564	28,078	28,614	29,095	29,712
Retail	19,355	19,772	20,501	21,187	21,596	21,966	22,295	22,788
Wholesale	5,997	5,982	6,163	6,377	6,482	6,648	6,800	6,924
Manufacturing	18,106	18,076	18,323	18,526	18,496	18,675	18,806	18,543

Source: BLS

Crude Labor Productivity	1992	1993	1994	1995	1996	1997	1998	1999
Total (1000s $1992/employee)	58.2	60.0	61.8	63.2	65.3	67.8	69.8	72.2
Trade	38.1	39.2	41.2	41.6	43.3	45.7	48.4	50.5
Retail	28.5	29.2	30.3	30.5	31.8	33.7	35.7	37.6
Wholesale	69.1	72.3	77.8	78.5	81.7	85.3	89.8	92.9
Manufacturing	59.8	62.6	66.8	69.6	71.1	73.9	76.4	80.9

Crude Labor Productivity Growth	1992	1993	1994	1995	1996	1997	1998	1999
Total (percent change from prior period)		3.1	3.0	2.2	3.4	3.8	3.0	3.4
Trade		2.9	5.1	0.9	4.1	5.4	5.9	4.3
Retail		2.6	3.6	0.8	4.2	6.0	6.0	5.2
Wholesale		4.6	7.5	0.9	4.1	4.4	5.4	3.4
Manufacturing		4.7	6.7	4.2	2.2	3.8	3.4	6.0

Table 1b: Components of the Retail and Wholesale Trade Industries

		Paid employees			
		1997		1992	% Change
Retail Trade		21,265,862		18,407,453	15.5
52	Building materials, hardware, garden supply and mobile home dealers	830,357		665,747	24.7
53	General Merchandise stores		--	2,078,530	
54	Food stores	3,109,336		2,969,317	4.7
55	Automotive dealers and gasoline service stations	2,283,756		1,942,613	17.6
56	Apparel and accessory stores	1,116,140		1,144,587	-2.5
57	Home furniture, furnishings, and equipment stores	861,605		702,164	22.7
58	Eating and drinking places		--	6,547,908	
59	Miscellaneous Retail	2,795,472		2,356,587	18.6
Wholesale Trade		6,509,333		5,791,264	12.4
50	Durable goods	3,887,371		3,349,064	16.1
51	Nondurable goods	2,621,962		2,442,200	7.4

Chart 1: Labor Productivity Growth by Sector

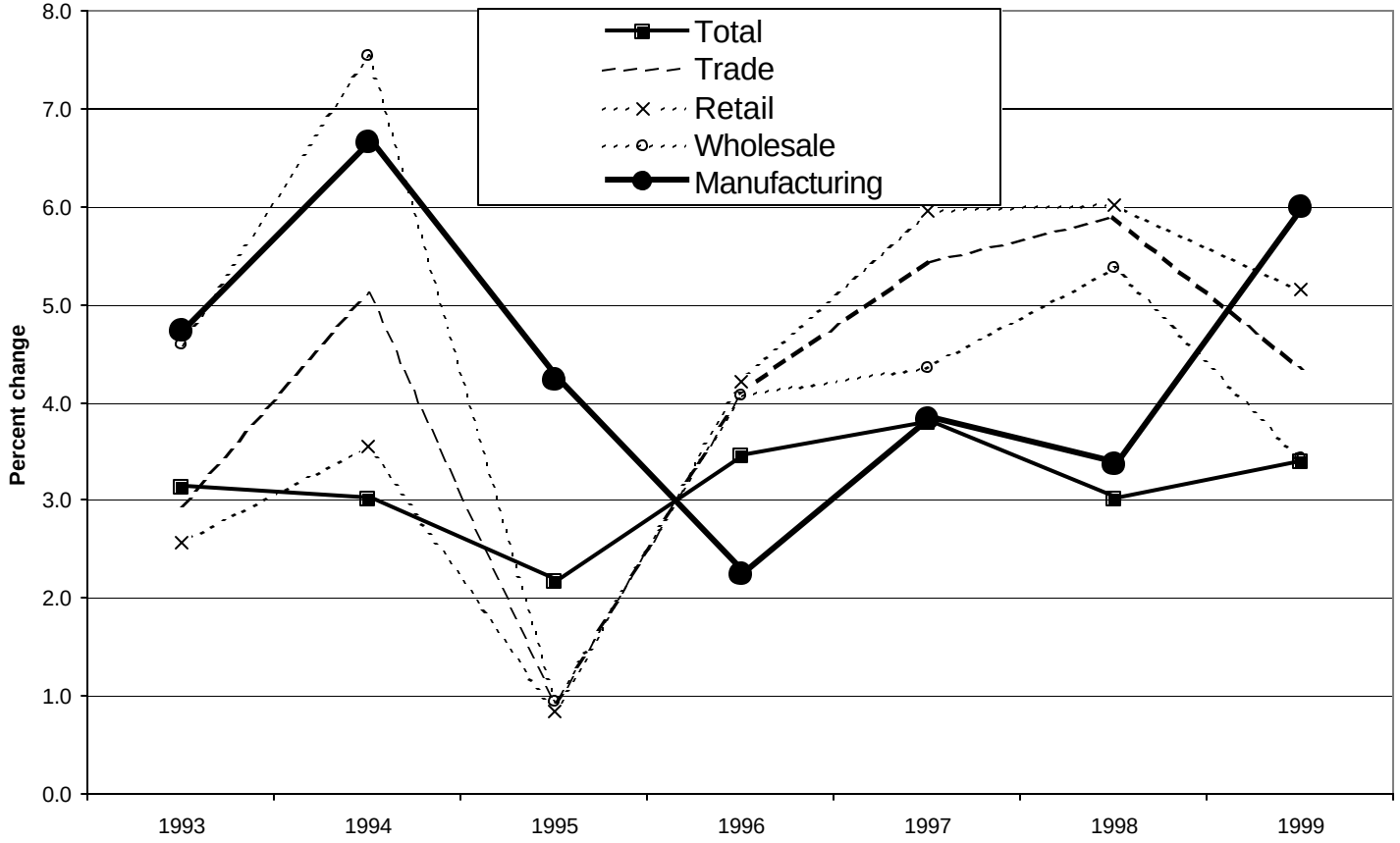

Table 2: Descriptive Statistics for the 1992 and 1997 Censuses of Retail Trade

Employment Size Class	# Of Firms, 1992	# of Continuing Firms	# Of Firms, 1997	# of Establishments, 1992	Net Change in # of Establishment at Continuing Firms	Net Change in # of Establishments from Net Entry of Firm's	# of Establishments, 1997
0 – 9	814,902	336,765	806,329	824,914	-6,446	-4,976	813,492
10 - 19	137,236	83,961	144,137	157,301	-3,130	5,676	159,847
20 - 49	84,545	56,674	92,374	119,455	-2,096	7,737	125,096
50 - 99	22,402	16,664	25,507	50,661	-377	3,970	54,254
100 - 499	10,794	8,894	12,437	81,634	-207	1,053	82,480
500 +	1,858	1,740	2,071	292,250	17,277	16,499	326,026
Total	1,071,737	504,698	1,082,855	1,526,215	5,021	29,959	1,561,195

Source: Authors' calculations using 1992 and 1997 Census of Retail Trade, Center for Economic Studies

Table 2 Continued

Employment Size Class	Employment, 1992	Net Change in Employment at Continuing Firms	Net Change in Employment from Net Entry of Firms	Employment, 1997
0 - 9	2,558,086	-17,482	28,712	2,569,316
10 - 19	1,829,730	18,658	77,479	1,925,867
20 - 49	2,528,883	72,067	162,710	2,763,660
50 - 99	1,502,267	75,939	134,824	1,713,030
100 - 499	1,991,904	141,520	148,220	2,281,644
500 +	7,997,583	1,610,763	303,999	9,912,345
Total	18,408,453	1,901,465	855,944	21,165,862

Table 3: Descriptive Statistics for Firms: All Retail - 1992 and 1997

Employment Size Class	Number 1992	Number 1997	Average Labor Productivity, 1992	Average Labor Productivity, 1997	Average Productivity Growth
0 – 9	814,902	806,329	4.267	4.345	-0.057
10 – 19	137,236	144,137	3.940	4.043	0.092
20 – 49	84,545	92,374	3.905	3.982	0.110
50 – 99	22,402	25,507	4.084	4.233	0.133
100 - 499	10,794	12,437	4.126	4.319	0.152
500 +	1,858	2,071	4.309	4.358	0.100
Entrants	NA	554,716	NA	4.182	NA
Exiters	543,598		4.016	na	na

Source: Authors' calculations using 1992 and 1997 Census of Retail Trade, Center for Economic Studies

Labor productivity is the log of Sales per employee, where sales in measured in thousands of nominal dollars.

Table 4: Descriptive Statistics for Firms: Matched Subset - 1992 and 1997

Employment Size Class	Number 1992	Number of Continuers 1997	Number of Estabs, 1992	Number of Estabs, 1997	Employment 1992	Employment 1997	Average Labor Productivity, 1992	Average Labor Productivity, 1997	Average Productivity Growth
0 – 9	7,980	4,491	8,963	4,969	33,172	19,594	4.533 / 4.636	4.671	-0.054
10 – 19	2,926	1,846	4,288	2,554	39,587	25,359	4.557 / 4.697	4.705	0.073
20 – 49	2,630	1,795	5,683	3,711	82,262	56,294	4.692 / 4.862	4.894	0.098
50 – 99	1,256	1,041	4,600	3,783	86,774	72,834	4.988 / 5.074	5.136	0.109
100 – 499	1,416	1,211	20,286	15,446	303,068	258,456	4.891 / 5.120	5.190	0.110
500 +	921	874	217,893	211,990	6,173,295	7,014,329	4.678 / 4.741	4.799	0.090
Total	17,129	11,258	261,713	242,453	6,718,158	7,446,866			

Source: Authors' calculations using '92 and '97 Census of Retail Trade and 1992 Asset and Expenditures Survey, Center for Economic Studies Labor productivity is the log of Sales per employee, where sales in measured in thousands of nominal dollars.

Table 5: Descriptive Statistics for Firms: Matched Subset - 1992 and 1997

Investment Intensity Category	Number	Number of Estabs, 1992	Number of Estabs, 1997	Employment 1992	Employment 1997	Average Labor Productivity, 1992	Average Labor Productivity, 1997	Average Productivity Growth
Zero or Missing Total Investment	6,320	34,136	27,602	472,252	463,455	4.559	4.698	0.020
Low Total ; Zero or missing IT	3,099	22,789	20,832	427,943	407,141	4.898	4.997	0.037
Low Total ; Low IT	4,449	100,831	85,572	2,104,421	2,119,736	4.795	5.013	0.032
Low Total: High IT	440	5,653	5,104	111,832	102,636	4.732	4.884	0.050
High Total; Zero or Missing IT	753	8,506	8,952	215,248	232,340	4.426	4.512	0.046
High Total; Low IT	1,270	64,626	67,942	2,272,209	2,786,819	4.186	4.502	0.084
High Total; High IT	798	25,172	26,449	1,114,263	1,334,739	4.127	4.621	0.167

Source: Authors' calculations using '92 and '97 Census of Retail Trade and 1992 Asset and Expenditures Survey, Center for Economic Studies

Table 6. Descriptive Statistics By Two-Digit SIC: All 1992 Firms

Two Digit SIC	Number of Firms, 1992	Average Employment, 1992	Average Survivor Employment, 1997	Average Number of Establishments, 1992	Average Number of Establishments at survivors, 1997	Average Labor Productivity, 1992	Average Survivor Labor Productivity, 1997	Average Change in Labor Productivity at Survivors
52	55,199	12	12	1.258	0.768	4.595	4.737	1.8%
53	10,264	203	235	3.371	2.754	4.283	4.375	-7.3%
54	127,575	23	21	1.415	0.792	4.428	4.563	-3.4%
55	142,256	14	12	1.417	0.954	5.094	5.286	3.8%
56	63,020	18	15	2.308	1.367	4.162	4.316	-5.4%
57	79,610	9	8	1.382	0.817	4.522	4.636	-1.4%
58	331,488	20	15	1.308	0.757	3.402	3.493	-2.4%
59	262,325	9	8	1.336	0.820	4.302	4.474	1.7%

Table 7. Descriptive Statistics By Two-Digit Industry: Matched Subset

Two Digit SIC	Number of Firms, 1992	Average Employment, 1992	Average Employment, 1997	Average Number of Establishments, 1992	Average Number of Establishments, 1997	Average Labor Productivity, 1992	Average Labor Productivity, 1997	Average Change in Labor Productivity
52	796	228	318	9.869	9.865	4.826	4.999	3.3%
53	664	2,896	3,489	29.486	28.944	4.339	4.409	-6.2%
54	1,304	1,053	1,112	21.714	20.339	4.577	4.673	-0.008%
55	3,422	111	122	8.971	8.684	5.421	5.612	8.0%
56	2,491	235	215	23.898	19.056	4.334	4.507	1.0%
57	2,898	73	88	7.030	6.716	4.767	4.923	7.2%
58	1,529	896	893	28.369	27.063	3.462	3.573	0.4%
59	4,025	173	212	12.914	12.628	4.513	4.680	3.2%

Table 7, Continued.

Two Digit SIC	Number of Firms, 1992	Capital Expenditures, 1992	Computer Expenditures, 1992	Average Capital Expenditures as a % of Sales, 1992	Average Computer Expenditures as a % of Sales, 1992
52	796	1,060,403	109,736	4.8%	0.4%
53	664	14,661,495	1,190,886	2.0%	0.1%
54	1,304	2,955,922	107,187	2.0%	0.0.6%
55	3,422	336,738	18,947	1.5%	0.07%
56	2,491	314,663	31,087	2.2%	0.2%
57	2,898	201,689	21,382	1.8%	0.2%
58	1,529	1,344,707	36,530	4.9%	1.9%
59	4,025	476,191	48,891	2.6%	0.3%

Labor productivity is the log of Sales per employee, where sales in measured in thousands of nominal dollars.

Capital expenditure included new and used equipment and buildings but exclude land. Computer investment is for computer hardware and data processing equipment.

Table 8: Simple Labor Productivity Growth Regressions

Variable		Model 1 coefficient	Model 1 standard error	Model 2 coefficient	Model 2 standard error	Model 3 coefficient	Model 3 standard error
Constant		1.243	0.072	1.273	0.073	1.312	0.074
Employment Size Class	0 - 9	-0.193	0.023	-0.195	0.023	-0.194	0.023
	10 -19	-0.050	0.024	-0.058	0.024	-0.052	0.025
	20 - 50	-0.008	0.024	-0.019	0.024	-0.011	0.025
	50 - 100	0.023	0.027	0.010	0.027	0.021	0.027
	100 -500	0.024	0.026	0.014	0.026	0.024	0.026
	500 +	-	-	-	-	-	-
log(wage)		-0.108	0.007	-0.111	0.007	-0.111	0.007
Capital Investment Intensity Quartile	1st	-0.126	0.019			-0.092	0.021
	2nd	-0.095	0.020			-0.071	0.020
	3rd	-0.110	0.020			-0.095	0.020
	4th	-	-			-	-
Computer Investment Intensity Quartile	1st			-0.160	0.025	-0.119	0.027
	2nd			-0.101	0.025	-0.068	0.026
	3rd			-0.069	0.025	-0.041	0.025
	4th			-	-	-	-
Capital Investment zero or missing		-0.071	0.018			-0.051	0.020
Computer Investment zero or missing				-0.081	0.019	-0.059	0.022
SIC 52: Building Materials and Hardware Stores		0.016	0.027	0.013	0.027	0.017	0.027
SIC 53: General Merchandise Stores		-0.155	0.031	-0.150	0.031	-0.152	0.031
SIC 54: Food Stores		-0.100	0.022	-0.087	0.022	-0.089	0.022
SIC 55: Automotive Dealers and Gas Stations		0.038	0.016	0.043	0.016	0.048	0.016
SIC 56: Apparel and Accessory Stores		-0.038	0.019	-0.035	0.019	-0.038	0.019
SIC 57: Home Furniture and Equipment Stores		0.068	0.017	0.066	0.017	0.070	0.017
SIC 58: Eating and Drinking Places		-0.133	0.023	-0.107	0.022	-0.121	0.023
SIC 59: Miscellaneous Retail		-	-	-	-	-	-

Source: Authors' calculations using '92 and '97 Census of Retail Trade and 1992 Asset and Expenditures Survey, Center for Economic Studies

Table 9: Establishment Growth Regressions

Variable		Model 1 coefficient	Model 1 standard error	Model 2 coefficient	Model 2 standard error	Model 3 coefficient	Model 3 standard error
Constant		-0.326	0.049	-0.305	0.050	-0.287	0.050
Employment Size Class	0 - 9	0.065	0.016	0.061	0.016	0.068	0.016
	10 -19	0.032	0.017	0.029	0.017	0.035	0.017
	20 - 50	0.007	0.017	0.006	0.017	0.010	0.017
	50 - 100	0.030	0.019	0.029	0.019	0.032	0.019
	100 -500	-0.011	0.018	-0.012	0.018	-0.010	0.018
	500 +	-	-	-	-	-	-
log(wage)		0.032	0.005	0.032	0.005	0.031	0.005
Capital Investment Intensity Quartile	1st	-0.051	0.013			-0.034	0.015
	2nd	-0.027	0.013			-0.012	0.014
	3rd	-0.051	0.013			-0.037	0.014
	4th	-	-	-	-	-	-
Computer Investment Intensity Quartile	1st			-0.061	0.017	-0.046	0.019
	2nd			-0.083	0.017	-0.073	0.018
	3rd			-0.065	0.017	-0.054	0.017
	4th			-	-	-	-
Capital Investment zero or missing		-0.065	0.012			-0.045	0.014
Computer Investment zero or missing				-0.080	0.013	-0.058	0.015
SIC 52: Building Materials and Hardware Stores		0.006	0.018	0.006	0.018	0.007	0.018
SIC 53: General Merchandise Stores		-0.039	0.021	-0.037	0.021	-0.038	0.021
SIC 54: Food Stores		-0.005	0.015	0.008	0.015	0.006	0.015
SIC 55: Automotive Dealers and Gas Stations		0.024	0.011	0.027	0.011	0.028	0.013
SIC 56: Apparel and Accessory Stores		-0.028	0.013	-0.029	0.013	-0.028	0.013
SIC 57: Home Furniture and Equipment Stores		0.000	0.012	0.000	0.012	0.001	0.012
SIC 58: Eating and Drinking Places		0.048	0.015	0.058	0.015	0.053	0.016
SIC 59: Miscellaneous Retail		-	-	-	-	-	-